NOTEBOOK COMPUTER WITH WRIST SUPPORT

Cross Reference To Related Applications

This is a continuation of U.S. patent application no. 09/731,142 filed December 6, 2000 which is a continuation-in-part of U.S. patent application no. 09/165,658 filed October 3, 1998.

Field Of The Invention

The invention relates to notebook computers and wrist supports.

Background Of The Invention

Frequent use of computer keyboards can lead to hand strain and repetitive motion injuries such as Carpal Tunnel Syndrome. To prevent these injuries, cushioned pads have been developed that elevate and support a computer operator's wrists while the operator is using a computer keyboard.

A conventional wrist support pad is typically composed of a moldable, gel-like or sponge-like substance that is encased in a non-porous sheath and supported on its bottom by a rigid or semi-rigid base. It is rectangular in shape with a length generally greater than 18 inches and a width usually between about 3 and 5 inches. The length of the pad is fashioned so that it overlaps or approximates the width of a standard keyboard. The width of the pad is designed to accommodate an average person's wrist. Because conventional wrist support pads are generally not affixed to a keyboard or a computer, they may be placed in any one of a multitude of positions to suit a particular computer operator and/or a particular keyboard.

Although wrist support pads come in a variety of shapes and sizes, most are designed for use with the standard full-size keyboards that are commonly used with desktop computers, and not for the type of keyboards that are integrated within the body of portable notebook computers. Thus, existing wrist support pads are often awkward to use with notebook computers. For

example, notebook computers often have keyboards that are placed several inches away from the front edge of the computer body. Positioning a wrist support pad immediately in front of the front edge of the computer body leaves the space between the pad and the keyboard too large for comfortable use by a person with average size hands. Moreover, positioning conventional wrist support pads on top of a notebook computer body immediately in front of the keyboard usually interferes with the use of other functional components of the computer, such as its pointing device (e.g., touchpad or trackball), microphone, or speakers.

Summary Of The Invention

The invention relates to notebook computers having built-in wrist support devices. The invention also relates to wrist support devices that are compatible with conventional notebook computers.

In one aspect, the invention features a notebook computer having a computer body, a keyboard, and a wrist support that is integrated within the computer body. In one variation of this notebook computer, the wrist support is integrated within the top panel of the computer body. In another variation, the wrist support is integrated within the front panel of the computer body.

In preferred embodiments, the notebook computers of the invention feature a wrist support that is reversibly inflatable. Some of these notebook computers further feature an inflation controller that includes a fluid pump and/or a bleed valve. In some variations, these notebook computers also feature an inflation control switch that regulates the inflation controller.

Also within the invention is a wrist support for use with a notebook computer keyboard. This wrist support includes a base having one or more flat surfaces, wherein the largest of these flat surfaces has a surface area of less than about 60 cm^2. Some embodiments of this wrist support include a fastener for attaching the wrist support to a notebook computer. In the preferred embodiment, this wrist support features a reversibly inflatable bladder.

The invention also features a wrist support kit that includes the aforementioned wrist

support with fastener, and an acceptor that can be affixed to a notebook computer in order to supply a connection site for the fastener.

Another feature of the invention is a notebook computer kit that includes a wrist support, a fastener, an acceptor, and a notebook computer. Some embodiments of this notebook computer kit also contain instructions for using (i.e., attaching the wrist support to the notebook computer) the notebook computer kit.

Also within the invention is a notebook computer including: a computer body having a front panel and a top panel, a keyboard, and a wrist support, the wrist support being compressible and integrated within the computer body. In various versions of this notebook computer the wrist support can be integrated within the top panel or the front panel of the computer body. In the latter, the front panel of the computer body can include a panel door behind which the wrist support can be stowed, and the panel door can be reversibly configurable between an open position and a closed position.

In notebook computers within the invention, the wrist support can be reversibly inflatable. For example, the notebook computer can further include an inflation controller fluidly connected to the wrist support. This inflation controller can include a fluid pump mounted on the notebook computer. In some variations, the inflation controller can include a bleed valve such as one that automatically opens when it is subjected to a predetermined threshold level. In other variations, the notebook computer can further include an inflation control switch operatively connected to the inflation controller, e.g., an inflation control switch that is switchable between an inflate position, a stop position, and a deflate position, whereby placement of the inflation control switch in the inflate position activates the inflation controller to inflate the wrist support, placement of the inflation control switch in the deflate position activates the inflation controller to deflate the wrist support, and placement of the inflation control switch in the stop position inactivates the inflation controller such that it neither inflates or deflates the wrist support. The inflation control switch can be a push-button type switch.

The notebook computers of the invention can also feature a wrist support that includes an

elastic bladder, the bladder being fillable with a compressible substance such as a synthetic sponge
(e.g., latex or synthetic rubber) and/or a fluid such as air.

The notebook computers of the invention, in some varaitations, also feature a wrist support that is reversibly detachable from the computer body. The wrist support can, for example, be attached to the computer body by a hook and loop type connector, a magnetic connector, or a mechanical connector.

Notebook computers within the invention can include a computer body having a front panel and a top panel, a keyboard, and a wrist support, the wrist support being filled with a gel and integrated within the computer body (e.g., into the front panel or top panel of the computer body). In versions where the wrist support is integrated within the top panel of the computer body, the computer body can further include at least one depression in the front panel of the computer body, the at least one depression being adapted to engage the wrist support.

Other notebook computers within the invention include a computer body having a front panel and a top panel, a keyboard, and at least a first and a second depression in the front panel of the computer body, the first depression being adapted to engage a first wrist support, and the second depression being adapted to engage a second wrist support. These notebook computers can further include a first gel-filled wrist support and a second gel-filled wrist support, the first gel-filled wrist support being mounted in the first depression, and the second gel-filled wrist support being mounted in the second depression. In addition these notebook computers can further include a pointing device, the pointing device being mounted on the computer body between the first depression and the second depression.

As used herein, the word "keyboard" is used in a generic sense to refer to any device that is used in a repetitive manner to input data into a computer, calculator or like device.

When one object is "integrated" within a second object, it is physically and functionally affixed to and designed to operate in accord with the second object. Thus, when a wrist support is "integrated" within a computer body, it is attached to the computer body in such a manner that

both wrist support and computer body operate as one unit.

Unless otherwise defined, all technical terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described below. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety. In the case of conflict, the present specification, including definitions will control. In addition, the particular embodiments discussed below are illustrative only and not intended to be limiting.

Brief Description Of The Drawings

The invention is pointed out with particularity in the appended claims. The above and further advantages of this invention may be better understood by referring to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of one embodiment of the invention;

FIG. 2A is a right side view of the embodiment shown in FIG. 1, shown with the wrist support deflated and the video display support in the closed position;

FIG. 2B is a right side view of the embodiment shown in FIG. 1, shown with the wrist support deflated and the video display support in the open position;

FIG. 2C is a right side view of the embodiment shown in FIG. 1, shown with the wrist support inflated and the video display support in the open position;

FIG. 2D is a side view of the wrist support, inflation controller, and inflation control switch of the embodiment shown in FIG. 1, shown with the wrist support fluidly connected to the inflation controller, and the inflation control switch operatively connected to the inflation controller.

FIG. 3A is a perspective view of another embodiment of the invention, shown with the wrist support panel door in the closed position;

FIG. 3B is a perspective view of the embodiment shown in FIG. 3A, shown with the wrist support panel door in the open position and the wrist support deflated;

FIG. 3C is a perspective view of the embodiment shown in FIG. 3A, shown with the wrist support panel door in the open position and the wrist support inflated;

FIG. 4A is a side view of a detachable wrist support shown in an uninflated position;

FIG. 4B is a side view of the detachable wrist support featured in FIG. 4A shown in an inflated position;

FIG. 4C is a side view of a notebook computer and a detachable wrist support, shown with the wrist support detached from the notebook computer;

FIG. 4D is a side view of a notebook computer and a detachable wrist support, shown with the wrist support attached to the notebook computer and in an uninflated position;

FIG. 4E is a side view of a notebook computer and a detachable wrist support, shown with the wrist support attached to the notebook computer and in an inflated position; and

FIG. 5 is a perspective view of a notebook computer and a detachable wrist support, shown with the wrist support attached to the notebook computer.

FIG. 6 is a cross-sectional view taken through the body of a notebook computer having a gel-filled wrist support integrated in the computer body.

Detailed Description

The invention encompasses notebook computers having an integrated wrist support as well as standard notebook computer components such as a keyboard, pointing device and computer body. As can be seen by comparing different models of currently available notebook computers (e.g., IBM Thinkpad 770™ and Compaq Presario® computers), these standard components may be arranged in myriad different orientations. This notwithstanding, two types of conventional layouts predominate in the marketplace. The first of these has a keyboard oriented on top of the computer body near the video display (see, e.g., FIG. 1). This layout features a relatively large unoccupied space on top of the computer body in the area between the

keyboard and the front edge of the computer body. A pointing device such as a touchpad is usually located within this space. In the second type of conventional layout, the keyboard is placed on top of and near the front edge the computer body (see, e.g., FIG. 3A). This layout has only a very small unoccupied space on top of the computer body in the area between the keyboard and the front edge of the computer body.

The below described preferred embodiments illustrate adaptations of wrist supports for use with notebook computers having their components arranged in each of these two conventional layouts. Nonetheless, from the description of these embodiments, other notebook computers of the invention can be readily fashioned by repositioning and/or making slight modifications to the components discussed below.

In brief overview, referring to FIGS. 1, 2A, 2B, 2C, and 2D, an embodiment of notebook computer **5** includes a computer body **10** having a front panel **11**, side panels **12** (right side panel is shown; left side panel is not shown), a top panel **13a**, a bottom panel **13b** and a back panel **14**; a video display support **15** containing a video display **16**; wrist supports **17a** (left) and **17b** (right); a pointing device **18**; a keyboard **19**; an inflation controller **20**; an inflation control switch **21**; a fluid connector **28**; and a switch connector **29**.

The notebook computer **5** shown in FIGS. 1, 2A, 2B, and 2C shares many of the same components featured in conventional notebook computers. For example, the bulk of the physical structure of notebook computer **5** consists of computer body **10** and video display support **15**. Each of these serve as a supportive and protective housing for other components of the computer. Both computer body **10** and video display support **15** are typically composed of a hard durable material such as a plastic (e.g., polyvinyl chloride) or a metal alloy (e.g., a magnesium alloy). Computer body **10** has a rectangular polyhedron shape formed by front panel **11**, side panels **12**, top panel **13a**, bottom panel **13b** and back panel **14**. It is movably attached to video display support **15** by a hinge such that video display support **15** can be reversibly positioned immediately on top of and roughly parallel to top panel **13a** (i.e., in the closed position; see FIG.

2A for example) or at various angles away from top panel **13a** (i.e., in an open position; see FIGS. 2B and 2C for example). The interior of computer body **10** houses various functional parts of the computer such as a central processing unit (CPU), a hard drive, a floppy disk drive, a CD-ROM drive, a battery, etc. The exterior of computer body **10** features devices such as pointing device **18**, keyboard **19**, a power switch, a microphone, speakers, etc. Video display support **15** houses video display **16** (e.g., an LCD video monitor) which is operatively linked to other functional parts of the computer. The above features are functionally connected in a similar manner as in conventional notebook computers.

Also included within the notebook computer **5** shown in FIGS. 1, 2A, 2B, and 2C are wrist supports **17a** (left) and **17b** (right), inflation controller **20**, and inflation control switch **21**. In the embodiment shown, wrist supports **17a** (left) and **17b** (right) are integrated into computer body **10** at the portions of top panel **13a** on each side of pointing device **18** in a position immediately forward of keyboard **19**. This orientation is such that the user of notebook computer **5** can comfortably rest his wrists or palms on wrist supports **17a** (left) and **17b** (right) while his fingers are located in a position convenient for typing on keyboard **19**. Wrist supports **17a** and **17b** are basically bladders composed of an elastic material (e.g., latex or synthetic rubber) that are fillable with a fluid such as a gas (e.g., air, carbon dioxide, or nitrogen) and fluidly connected to a fluid source (e.g., atmospheric air) via fluid connector **28** (see FIG. 2D), a device for transferring fluid from one source to another (e.g., non-porous tubing or the like). They may optionally be covered with fabric (e.g., nylon, polyester, etc.) to enhance their comfort and durability. Each wrist support **17** is reversibly expandible in size by adding or decreasing the amount of fluid contained therein. Wrist supports **17a** and **17b** may be fluidly connected to each other to form one structure (i.e., wrist support **17**). Alternatively, wrist supports **17a** and **17b** can lack a fluid connection to each other. The latter configuration is preferred where it is desirable to have left and right wrist supports that are independently adjustable.

Inflation controller **20** is a device that regulates the amount of fluid in wrist support **17**.

In a preferred embodiment, inflation controller **20** comprises a two-way fluid pump that is mounted at a predetermined location on notebook computer **5** (e.g., on computer body **10** at side panel **12** as shown in FIG. 1). In another preferred embodiment, inflation controller **20** comprises a fluid pump and a bleed valve. In either case, as shown in FIG. 2D, the fluid pump (and the bleed valve in the latter configuration) of inflation controller **20** is connected to wrist support **17** and a fluid source (e.g., the air in the atmosphere surrounding notebook computer **5**) by fluid connector **28** such that the fluid may reversibly flow from the fluid source through inflation controller **20** into wrist support **17**. Where wrist supports **17a** and **17b** are not fluidly connected to each other, inflation controller **20** is separately connected to wrist support **17a** and wrist support **17b** such that it independently controls inflation of each wrist support (e.g., there is a separate fluid pump for each wrist support).

Activation of inflation controller **20** causes fluid to flow through fluid connector **28** between the fluid source (e.g., atmospheric air) and wrist support **17**. Activation of the fluid pump portion of inflation controller **20** in a forward direction causes fluid to move from the fluid source through inflation controller **20** into wrist support **17**, thus inflating wrist support **17**. Activation of the fluid pump of inflation controller **20** in a reverse direction causes fluid to move from wrist pad **17** through inflation controller **20** out to the fluid source (e.g., the atmosphere), thus deflating wrist support **17**. In the configuration of inflation controller **20** that includes a bleed valve, opening the bleed valve causes fluid to flow out of wrist support **17** fluid connector **28** through fluid connector **28** into the atmosphere via inflation controller **20**, thus deflating wrist support **17**. In some configurations, the bleed valve portion of inflation controller **20** can be set to automatically open when a threshold fluid pressure is reached. Thus, when wrist support **17** reaches a certain predetermined size or pressure, the bleed valve opens and thereby releases fluid from wrist support **17**. In this manner, the maximum size to which wrist support **17** can be expanded can be automatically controlled.

Inflation control switch **21** is a switch device that regulates the operation of inflation

controller **20**. It is mounted on a predetermined site on notebook computer **5** that is accessible to a user. For example, in the embodiment shown in FIG. 1, inflation control switch **21** is affixed to computer body **10** on top panel **13a** near video display support **15**. As shown in FIG. 2D, inflation control switch **21** is operatively linked (e.g., mechanically, hydraulically, or electrically) to inflation controller **20** via switch connector **29**, a device that operatively links inflation control switch **21** to inflation controller **20** (e.g., an electrical wire, a mechanical cable, or hydraulic hosing). It has an inflate position, a stop position, and a deflate position. When placed in the inflate position, inflation control switch **21** signals inflation controller **20** to activate its fluid pump to send fluid into and thereby inflate wrist support **17**. When placed in the deflate position, inflation control switch **21** signals inflation controller **20** to reverse its fluid pump and/or open its bleed valve to thereby deflate wrist support **17**. When placed in the stop position, inflation control switch **21** signals inflation controller **20** to either stop inflating or stop deflating wrist support **17**.

An overview of the operation of the foregoing preferred embodiment is shown in FIGS. 2A, 2B, and 2C. In FIG. 2A, notebook computer **5** is shown in the closed position with wrist support **17** deflated. Deflation of wrist support **17** permits video display support **15** to be placed immediately on top of and roughly parallel to top panel **13a** so that notebook computer **5** is in a compact configuration (i.e., with video display support **15** in the closed position) that enhances the portability of notebook computer **5**. To operate notebook computer **5**, a user moves video display support **15** to an open position such that the user can view video display **16** (see, e.g., FIG. 2B) and then boots up the computer. To utilize wrist support **17**, the user then places inflation control switch **21** in the inflate position, thus activating the fluid pump of inflation controller **20** to send fluid into wrist support **17** via fluid connector **28**. When wrist support **17** is inflated to the desired size (one example is depicted in FIG. 2C), the user then places inflation controller switch **21** in the stop position to halt fluid flow into wrist support **17**. Thus, in this configuration, the user can operate notebook computer **5** much like a conventional notebook

computer except that his wrists or palms are comfortably propped on inflated wrist support **17**. Because wrist support **17** can be inflated to an infinite number of positions up to a maximum inflation position, each different user can adjust the size of wrist support **17** to his liking.

When the user has completed operating notebook computer **5**, he can restore it to the compact and portable configuration shown in FIG. 2A by placing inflation control switch **21** in the deflate position. In this position, inflation control switch **21** causes deflation of wrist support **17** by activating the fluid pump of inflation controller **20** to remove the fluid from wrist support **17** and/or opening the bleed valve portion of inflation controller **20** to thereby release the fluid from wrist support **17**. In some variations of this embodiment, the user can apply pressure to wrist support **17** (e.g., by manually squeezing wrist support **17**) to hasten the release of fluid from (and thus deflation of) wrist support **17**. When a sufficient amount of fluid is removed from wrist support **17**, inflation control switch **21** is placed in the stop position. The user can then place video display support **15** immediately on top of and roughly parallel to top panel **13a** (FIG. 2A).

In another variation of this preferred embodiment, operation of inflation control switch **21** is automatic or semiautomatic. For example, as shown in FIGS. 1, 2A, 2B, and 2C, inflation control switch **21** is positioned on top panel **13a** adjacent to video display support **15**. In this variation, inflation control switch **21** is designed as a pushbutton-type device (e.g., a spring-loaded piston movably mounted within an open-ended cylinder) that has a depressed position where the top of the pushbutton is approximately flush with the surface of top panel **13a**, and non-depressed positions where the pushbutton extends perpendicularly away from top panel **13a** for various short distances (such as 0.5, 1, or 2 cm) up to a maximum non-depressed position in which the pushbutton is fully extended. The pushbutton-type device is biased so that it is in the maximum non-depressed position in the absence of extraneous forces.

When the video display support of notebook computer **5** is in the closed position (such as shown in FIG. 2A), the pushbutton of inflation control switch **21** is held in the depressed

position by contact from a portion of video display support **15**. This position corresponds to the stop position discussed above (i.e., inflation controller **20** is inactivated). When video display support **15** is placed in an open position, the pushbutton of inflation control switch **21** rises to a non-depressed position as a result of its bias. This movement from a depressed position to a non-depressed position places inflation control switch **21** in the inflate position and thereby signals inflation controller **20** to send fluid into wrist support **17**. After wrist support **17** reaches a preset inflation level, inflation controller **20** automatically returns to an inactivated state (e.g., inflation controller **20** has a pressure sensor that turns off the fluid pump of inflation controller **20** when a threshold pressure is detected). Because the pushbutton of inflation control switch **21** abuts against a portion of video display support **15**, lowering video display support **15** to return it to the closed position gradually pushes inflation control switch **21** downward toward the depressed position. This downward push places inflation control switch **21** in the deflate position and thereby signals inflation controller **20** to remove fluid from wrist support **17**. With wrist support **17** deflated, video display support **15** can be returned to the closed position in which inflation control switch **21** is in the depressed or stop position.

Another preferred embodiment of the invention is shown in FIGS. 3A, 3B, and 3C. Similarly to the notebook computer discussed above and shown in FIGS. 1, 2A, 2B, 2C and 2D, this embodiment is a notebook computer that includes a computer body **10** having a front panel **11**, side panels **12** (right side panel is shown; left side panel is not shown), a top panel **13a**, a bottom panel **13b** (not shown) and a back panel **14** (not shown); a video display support **15** containing a video display **16**; a wrist support **17**; a keyboard **19**; an inflation controller **20**; an inflation control switch **21**; a fluid connector **28** (not shown); and a switch connector **29** (not shown). To illustrate how the above components of the notebook computers of the invention can be arranged in different orientations, notebook computer **5** in FIG. 1 can be compared to notebook computer **5** in FIG. 3A. For example, in the embodiment shown in FIG. 3A, keyboard **19** is oriented closer to front panel **11** than in the embodiment shown in FIG. 1. Likewise,

inflation control switch **21** is mounted on top panel **13a** near front panel **11** in the embodiment shown in FIG. 3A, whereas it is mounted near video display support **15** in the embodiment shown in FIG. 1.

In the embodiment shown in FIGS. 3A, 3B, and 3C, wrist support **17** of notebook computer **5** is contained within computer body **10** immediately behind front panel **11**. This embodiment is preferred for notebook computers having a keyboard placed on top panel **13a** at a location near front panel **11** (e.g., IBM Thinkpad 770™) as the lack of available space on the portion of top panel **13a** in front of keyboard **19** does not limit placement of wrist support **17**. This embodiment optionally features a wrist support panel door **22** that is composed of a material similar to that composing computer body **10** (such as plastic or metal). Wrist support panel door **22** is typically rectangular in shape, and attached to and integrated within front panel **11**. As an example, FIGS. 3A and 3B show wrist support panel door **22** hingedly attached to the bottom of front panel **11**. Wrist support panel door **22** has a closed position and open positions. In the closed position, wrist support panel door **22** is reversibly locked into computer body **10** by wrist support panel door clasp **22a** (any number of such clasps can be used; FIG. 3A shows two such clasps). One open position of wrist support panel door **22** is shown in FIG. 3B. Although wrist support panel door **22** is not required for the function of this embodiment, it is generally a preferred component as it protects wrist support **17** from damage and provides a convenient mechanism for storing wrist support **17** while it is not being used. One exemplary alternative configuration of this embodiment (not shown) has wrist support **17** integrated into computer body **10** at front panel **11** with front panel **11** having a cut-out portion through which wrist support **17** can expand. This configuration resembles notebook computer **5** shown in FIG. 3B except that wrist support panel door **22** is omitted.

In the preferred embodiment, wrist support **17** is a single unit (albeit, multiple wrist supports could also be used) that is essentially a bladder composed of an elastic material (e.g., latex or synthetic rubber). This bladder is fillable with a fluid such as a gas (e.g., air, carbon

dioxide, or nitrogen) and fluidly connected to a fluid source (e.g., atmospheric air) via fluid connector **28** (not shown, but see FIG. 2D for a similar example), so that wrist support **17** can be reversibly expanded by adding or decreasing the amount of fluid contained therein. Wrist support **17** is shaped (e.g., the elastic material is pre-molded) so that when expanded it develops a shape conducive for comfortable typing by an operator of the notebook computer. It may optionally be covered with fabric (e.g., nylon or the like) to enhance its feel (i.e., comfort for a user) and/or durability.

The components of this embodiment function quite similarly to the components of the embodiment shown in FIGS. 1, 2A, 2B, and 2C. For example, in this embodiment, inflation controller **20** also comprises a two-way fluid pump (or a fluid pump and a bleed valve) that is mounted at a predetermined location on notebook computer **5**. It is also connected to wrist support **17** and a fluid source (e.g., the air in the atmosphere surrounding notebook computer **5**) via fluid connector **28** (not shown) such that the fluid can reversibly flow from the fluid source through inflation controller **20** into wrist support **17**. Activation of the fluid pump portion of inflation controller **20** in a forward direction causes fluid to flow into (and thereby inflate) wrist support **17**. Reversing the direction of the fluid pump removes fluid from (and thereby deflates) wrist pad **17**. Where a bleed valve is included as part of inflation controller **20**, opening the bleed valve causes fluid to flow out of (and thereby deflate) wrist support **17**.

This embodiment also features an inflation control switch **21** for regulating the operation of inflation controller **20**. It is placed at a predetermined site on notebook computer **5** (in FIGS. 3A, 3B, and 3C it is shown on top panel **13a** near front panel **11** and right side panel **12**), and is operatively linked to inflation controller **20** via switch connector **29** (not shown; but see FIG. 2D for a similar example). It has an inflate position, a stop position, and a deflate position. When placed in the inflate position, inflation control switch **21** signals inflation controller **20** to activate its fluid pump to send fluid into and thereby inflate wrist support **17**. When placed in the deflate position, inflation control switch **21** signals inflation controller **20** to reverse it fluid pump and/or

open its bleed valve to thereby deflate wrist support **17**. When placed in the stop position, inflation control switch **21** signals inflation controller **20** to either stop inflating or stop deflating wrist support **17**.

The operation of this preferred embodiment is very similar to the operation of the embodiment shown in FIGS. 2A, 2B, 2C, and 2D. In FIG. 3A, notebook computer **5** is shown with wrist support **17** deflated and wrist support panel door **22** in the closed position. To inflate wrist support **17**, the user first opens wrist support panel door **22** and then places inflation control switch **21** in the inflate position, thus activating the fluid pump of inflation controller **20** to send fluid into wrist support **17**. In one variation of this embodiment, wrist support panel door clasp **22a** can be designed so that wrist support panel door **22** automatically opens while wrist support **17** is being inflated. For example, wrist support panel door clasp **22a** can be a hook and loop-type connector (e.g., Velcro®) that comes apart when subjected to a predetermined force such as the pressure caused by the inflation of wrist support **17**. When wrist support **17** is inflated to a desired size (e.g., as depicted in FIG. 3C), the user then places inflation controller switch **21** in the stop position to cut off fluid flow into wrist support **17**. To restore the compact and portable configuration of notebook computer **5** (as shown in FIG. 3A), inflation control switch **21** is placed in the deflate position. This causes inflation controller **20** to remove the fluid from wrist support **17** as described *supra*. In some cases, the user can apply pressure to wrist support **17** to hasten deflation of wrist support **17**. When a sufficient amount of fluid is removed from wrist support **17**, inflation control switch **21** can be placed in the stop position. The deflated wrist support **17** can be stowed in computer body **10** and secured by closing wrist support panel door **22**.

As shown in FIGS. 4A, 4B, 4C, 4D, 4E, and 5, another preferred embodiment of the invention is a wrist support that is detachably affixable to the body of a notebook computer. In this embodiment, wrist pad **17** includes an inflation controller **20**, a base **23**, a bladder **24**, bladder cover **25**, and a fastener **26**. To facilitate compatibility with notebook computers, the

total area of the largest flat surface of wrist pad **17** is less than about 60 cm^2 (e.g., 25, 30, 45, 50, or 55 cm^2). The specific dimensions and shape of wrist pad **17** can be chosen to match the particular layout of a given notebook computer.

Although, in some embodiments, base **23** can be used alone as a wrist support (especially if base **23** is composed of a soft, compressible material such as synthetic sponge such as latex or synthetic rubber), in the particular embodiment shown in FIGS. 4A, 4B, 4C, 4D, 4E, and 5, base **23** is a structure that forms and maintains the shape of the bottom portion of wrist pad **17**. It is roughly rectangular in shape and composed of a rigid or semi-rigid material such as plastic or reinforced rubber. Base **23** also serves as a structure on which to mount other components of wrist pad **17** such as bladder **24**, bladder cover **25**, and/or fastener **26**.

Bladder **24** is fixedly attached to base **23**. It is essentially an elastic balloon (e.g., a latex or synthetic rubber balloon) that is fillable with a compressible substance such as a gas (e.g., air, carbon dioxide, or nitrogen) or a sponge-like material (e.g., latex or synthetic rubber). By adding or decreasing the amount of compressible substance contained within bladder **24** (e.g., via a connection to a source of said substance), wrist support **17** can be reversibly expanded.

In a preferred configuration of this embodiment, the compressible substance is atmospheric air. In this configuration, bladder **24** is biased so as to be in an expanded configuration when not subjected to an extraneous force (much like the inflation bulb in a standard manual sphygmomanometer). Bladder **24** communicates with the atmosphere via inflation controller **20**, which in this embodiment is a valve directly attached to bladder **24** that has an open and a closed position. When inflation controller **20** is in the open position, air from the atmosphere can flow in and out of bladder **24**. When inflation controller **20** is in the closed position, air from the atmosphere cannot flow in or out of bladder **24**. Because of bladder **24**'s bias, when inflation controller **20** is in the open position bladder **24** is in an inflated state (see FIG. 4B). When the inflation controller **20** is then placed in the closed position, air cannot escape bladder **24**, and thus wrist support **17** is stabilized in the inflated state. When inflation

controller **20** is left in the open position, a user can compress (e.g., by manually squeezing) bladder **24** to a desired inflation state and then close inflation controller **20** so that the chosen inflation state is stabilized (see FIG. 4A).

Similarly, a user can partially or completely deflate wrist support **17** by partially or fully compressing bladder **24**. This deflated state can be stabilized by either continuing the compressing force, or by placing inflation controller **20** in the closed position. In this manner the size of wrist support **17** can be minimized to facilitate its portability and/or storage. In some variations, wrist support **17** can be deflated while attached to a notebook computer so that the video display support of the notebook computer can be placed in the closed position without wrist support **17** being detached.

Other components of the wrist support device shown in FIGS. 4A, 4B, 4C, 4D, 4E, and 5 include bladder cover **25**, fastener **26**, and acceptor **27**. Bladder cover **25** is a piece of fabric (e.g., nylon or the like) that is placed over bladder **24** (as shown in FIGS. 4A and 4B) in order to reinforce and protect bladder **24**, and/or to enhance the esthetics or feel (for user comfort) of wrist pad **17**. Fastener **26** and acceptor **27** are devices used for attaching wrist support **17** to notebook computer **5**.

Fastener **26** is attached to the bottom portion of wrist support **17**. It can be any type of device that can mediate the attachment of wrist support **17** to the surface of computer body **10** (e.g., an adhesive tape, a magnet, or a mechanical lock). In the preferred embodiment shown in FIGS. 4A, 4B, 4C, 4D, and 4E, fastener **26** is a one component of a hook and loop-type connector such as Velcro® (i.e., fastener **26** is the hook or the loop component of the connector). In this configuration, to affix wrist support **17** to notebook computer **5**, acceptor **27** is first mounted (e.g., using an adhesive) to an unoccupied area on the surface of computer body **10** (see FIG. 4C). Acceptor **27** is one component of a two component connector (e.g., a hook and loop-type connector) that is attachable to fastener **26**. For example, in the preferred embodiment, where fastener **26** is the hook component of a hook and loop-type connector, acceptor **27** will be

the loop component of the connector, and vice versa. As shown in FIG. 4D, wrist support **17** is then placed onto notebook computer **5** so that fastener **26** engages acceptor **27**. Wrist support **17** is thus affixed to the notebook computer (see FIG. 4D for a side view and FIG. 5 for a perspective view). While in this position wrist support **17** can be in a deflated position (FIG. 4D) or an inflated position (FIG. 4E). Wrist pad **17** can be removed from notebook computer **5** by simply prying it from the surface of computer body **10** with sufficient force to disengage fastener **26** from acceptor **27**. Wrist pad 17 can also be connected to computer body 10 by means of a magnetic connector, a mechanical connector, or any other suitable fastening device.

Also within the invention are gel-filled wrist supports for use with a notebook computer and notebook computers having a gel-filled wrist support integrated with the body of the notebook computer (e.g., in the top panel or in the front panel). These embodiments are similar to the fluid-fillable wrist support shown in the figures and described above except that the fluid is a gel such as a water-based gel, a stable elastomeric block polymer gel, urethane, and any other suitable gel. Examples of suitable elastomeric block polymer gels can be found in U.S. Pat. Nos. 3,676,388, 4,369,284, 5,633,286 and 5,713,544. Examples of polyurethane gels include those in U.S. Pat. Nos. 4,346,205; 4,476,258; 4,722,946; and 4,980,386.

The overall dimensions of the gel-filled wrist pad can be any suitable for use with a notebook computer, e.g., sized to fit on the top panel of a notebook computer without interfering with the operation of the notebook computer's other components (e.g., pointing device or keyboard). The thickness (i.e., from the bottom surface to the top surface of the wrist pad) of the wrist pad can be any suitable for comfortable use with a notebook computer, for example, between about 3 and 30 mm (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, and 30 mm). For use with conventional notebook computers, the thickness of the wrist pad, especially in those versions in which the gel is sealed within the wrist pad, is preferably small enough (e.g., between about 0.5 and 10 mm or between 1 and 5 mm) so that once the wrist support(s) is mounted on the top panel of the notebook computer, the

computer can be placed in the open and closed configurations without having to remove the wrist support(s).

For the notebook computers having a wrist support integrated in the top panel of the computer body, referring now to FIG. 6, the top panel can have one or more recessed depressions 42 (e.g., one or two receded portions of computer body 10 that can be circumscribed by a rigid material such as plastic) into which wrist support 17 (e.g., one that takes the form of a bladder 24 filled with gel 40 as shown in FIG. 6 or another wrist support described herein) can be inserted such that the thickness of the wrist support that projects above the top panel is reduced or eliminated. Depressions 42 can be of any size or shape suitable for accepting a wrist support. For example, they can have a depth (the distance from the plane of the top panel to the bottom of the depression) of between about 3 and 30 mm (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, and 30 mm). The other dimensions of the wrist pad should be suitable for being used in a notebook computer without interfering with the operation of other notebook computer components such as the pointing device and the key board. For example, the surface area of the bottom portion of the wrist pad 17 (i.e., the portion of wrist pad 17 in contact with the bottom of the depression 42 as shown in FIG. 6) can be less that about 100 cm^2 (e.g., 30, 40 , 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100 cm^2), although it can be larger in some configurations. The surface area of the top portion of wrist pad 17 (that is the portion of wrist pad 17 that would contact the notebook computer user's wrist or palm) should be large enough to support an average size wrist, e.g., between about 30 and 100 cm^2 (e.g., 40-90 cm^2, 50-80 cm^2 or 60-70 cm^2). The gel-filled wrist support of the invention can additionally feature a cover made of a durable material and/or a means for attaching the wrist pad to the depression (e.g., for versions of the wrist pads that are reversibly detachable from the computer body). Suitable materials for the cover and means for attaching the wrist pad to the depression are described above for other embodiments of the invention.

From the foregoing, it can be appreciated that the notebook computers and wrist supports of the invention permit the use of a keyboard in a comfortable and ergonomic manner.

While the above specification contains many specifics, these should not be construed as limitations on the scope of the invention, but rather as examples of preferred embodiments thereof. Many other variations are possible. For example, a notebook computer having an inflatable wrist support integrated into the top panel of the computer body wherein inflation of the wrist support causes it to expand in such a manner as to overlap the front panel of the computer body, is included within the invention. As another example, a notebook computer having a wrist support in communication with a self-contained, pressurized fluid reservoir (e.g., a tank containing pressurized nitrogen gas) such that the fluid reservoir can provide fluid to inflate the wrist support is within the invention. Accordingly, the scope of the invention should be determined not by the embodiments illustrated, but by the appended claims and their legal equivalents.

What is claimed is: